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WILKINSON BARKER KNAUER, LLP

Washington, DC
Frankfurt, Germany

2300 N Street, NW
Washington, DC 20037-1128

telephone: 202.783.4141
facsimile: 202.783.5851
www.wbklaw.com

January 19, 2000

Hand Delivered

Magalie Roman Salas, Secretary
Federal Communications Commission
445 Twelfth Street, S.W., TW-A325
Washington, D.C. 20554

Re: *Ex Parte* Presentation
Advanced E911 Coalition - CC Docket No. 94-102

Dear Ms. Salas:

This letter serves as notice that on Tuesday, January 18, 2000, the undersigned and Ellen Kirk and Len Sheynblat of SnapTrack, Inc., met with Kris Monteith, Mindy Littell, Blaise Scinto, Patrick Foster, and Dan Grosh of the Wireless Telecommunications Bureau's Policy Division, to discuss issues addressed in the above-referenced proceeding. The attached document was also distributed.

Pursuant to Section 1.1206(a), an original and one copy of this letter are being filed with your office. Please associate this letter with the file in the above-captioned proceeding.

Should you have any questions regarding this matter, please contact the undersigned.

Sincerely,

WILKINSON BARKER KNAUER, LLP

By: Kathleen Q. Abernathy
Counsel for SnapTrack, Inc.

Enclosure

cc: Kris Monteith, Wireless Telecommunications Bureau's Policy Division
Mindy Littell, Wireless Telecommunications Bureau's Policy Division
Blaise Scinto, Wireless Telecommunications Bureau's Policy Division
Patrick Forster, Wireless Telecommunications Bureau's Policy Division
Dan Grosh, Wireless Telecommunications Bureau's Policy Division

SnapTrack, Inc.

Ex Parte Presentation CC Docket No. 94-102

ALI Technology Performance Validation Methodology

Introduction

The standard in the Docket No. ET 99-300, which states that 67 percent of the calls shall be located within an *x*-meter circle centered at a ground truth (e.g., 50 meters for handset-based solution), is a statistical measure. As such, it must be addressed in statistical terms. The performance criterion in the standard is equivalent to determining the probability of locating a call with an x-meter accuracy. Equivalently, if the probability of locating a call with an error of *x* meters is greater than or equal to 67 percent for a particular ALI technology, then this ALI technology is compliant with the above mentioned standard.

The probability of locating a call with an *x*-meter accuracy can be determined by examining system performance under all possible E9-1-1 call scenarios. For exemplary purposes in this proposal, five scenarios are considered (the scenarios defined by the CDG Test Plan Document).

Relevant Definitions

Before proceeding with the derivation of a formula that should be used to assess the performance of ALI technology, the following definitions should be made:

Event E ≡ Location is determined with an error of less than *x* meters
Event A_1 ≡ Call originated in "Rural" signal environment
Event A_2 ≡ Call originated in "Suburban" signal environment
Event A_3 ≡ Call originated in "Urban" signal environment
Event A_4 ≡ Call originated in "Highway" signal environment
Event A_5 ≡ Call originated in "Water" signal environment

We shall use the symbols $\cup$ and $\cap$ for the union and intersection of events – the usual notation in elementary set theory. We shall also use $P(C)$ to denote the probability of occurrence of some event C; $P(C \cap D)$ to denote the probability of a joint occurrence of two events, C and D; and $P(C \mid D)$ to denote the conditional probability of occurrence of event C given that event D has occurred.

Based on the above notation and relevant definitions, $P(E)$ is the probability of a call being located with an accuracy better than *x* meters.

Derivation of performance validation methodology

Basic probability theory dictates that if $A_1, A_2 \ldots$ are pair-wise disjoint events, then

$$P\left(\bigcup_{i=1}^{\infty} Ai\right) = \sum_{i=1}^{\infty} P(Ai)$$

Note that the union of A_i is just a collection of points that are in any one of the events A_i and that two events are disjoint if they have no points in common.

Call origination is equivalent to a call being originated in any of the five scenarios. Additionally, an event of a call being originated in one environment is independent of an event of a call being originated in another environment. Therefore, the call origination events as defined above are pair-wise disjoint.

The probability of a call being originated in a specific signal environment $P(A_i)$ is based on an estimate of the relative frequency of E9-1-1 calls originating within that environment.

Since A_1, A_2, A_3, A_4, and A_5 are (pair-wise) disjoint events of positive probability whose union is Ω, the identity

$$E = \bigcup_{j=1}^{n} (E \cap Aj)$$

is equivalent in the five scenario case to

$$E = (E \cap A_1) \cup (E \cap A_2) \cup (E \cap A_3) \cup (E \cap A_4) \cup (E \cap A_5) \quad (1)$$

where

$$P(\Omega) = 1. \quad (2)$$

Eq.2 points out that the sum of all the call origination probabilities is identically equal to 1.

Combining Eq.1 with

$$P(C \cap D) = P(D)\, P(C \mid D) \quad (3)$$

yields

$$P(E) = \sum_{i=1}^{5} P(E \mid Ai) P(Ai)$$
$$= P(E \mid A_1)\, P(A_1) + P(E \mid A_2)\, P(A_2) + P(E \mid A_3)\, P(A_3) + P(E \mid A_4)\, P(A_4) + P(E \mid A_5)\, P(A_5) \quad (4)$$

An example of the application of the performance qualification criteria as expressed by Eq.4 is illustrated below for a particular handset-based ALI technology.

Example

In order to illustrate the applicability of performance verification methodology, the five test scenarios can be considered in the context of representative data. The following are the relevant definitions:

Event E ≡ Location is determined with an error of less than *50* meters

Event A_1 ≡ Call originated in "Rural" signal environment
Event A_2 ≡ Call originated in "Suburban" signal environment
Event A_3 ≡ Call originated in "Urban" signal environment
Event A_4 ≡ Call originated in "Highway" signal environment
Event A_5 ≡ Call originated in "Water" signal environment

The call origination probabilities related to carrier's current distribution of 9-1-1 calls were estimated as:

$$P(A_1) = 0.35,\ P(A_2) = 0.05,\ P(A_3) = 0.04,\ P(A_4) = 0.55 \text{ and } P(A_5) = 0.01.$$

Table below summarizes the single fix and multiple fix performance analysis. Remember that $P(E \mid A_i)$ designates the probability of location error being less than 50 meters given the call originated in the signal environment A_i. $P(E)$ is the sought after probability of being able to locate a call with an accuracy of 50 meters.

Environment	A_1 (rural)	A_2 (suburban)	A_3 (urban)	A_4 (highway)	A_5 (water)	$P(E)$
911 Call Distribution	**0.35**	**0.05**	**0.04**	**0.55**	**0.01**	
Single Fix $P(E \mid A_i)$	**0.65**	**0.85**	**0.95**	**0.75**	**0.85**	**0.73**
Multiple Fix* $P(E \mid A_i)$	**0.85**	**0.99**	**0.99**	**0.9**	**0.95**	**0.89**

In this example, the probability of 50-meter accuracy is 73% (better than the 67% requirement) if a single locate is attempted for each call.

Conclusion

Analysis presented in this proposal demonstrates that the standard's 50-meter accuracy for 67 percent of the calls can be met with the proposed performance validation methodology. It has also been verified that this methodology similarly can be applied to the standard of 150-meter accuracy for 95 percent of the calls.

* Five sequential independent fixes in the same location